Development of a Traditional Game-Based Computational Thinking Supplementary Textbook for Elementary School Students

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***Abstract**: This study aimed to develop a supplementary mathematics textbook on traditional game-based computational thinking for elementary school students. This textbook was developed using a research and development model consisting of five stages: analysis, design, development, implementation, and evaluation (ADDIE). The mathematical contexts of the textbook were based on four traditional Indonesian games integrated into four computational thinking skills: decomposition, pattern recognition, abstraction, and algorithms. The supplementary mathematics textbook was developed and validated by experts in mathematics and culture. The textbook was tested with 20 fourth-grade students. The findings of this study indicated that the supplementary mathematics textbook of traditional game-based computational thinking has high usability as rated by students. The students gave positive feedback for use of the textbook in the classroom because of its connection to culture and games. Therefore, the study enriches learning materials on culturally integrated computational thinking skills for elementary school students.*

Keywords: computational thinking, research and development, supplementary mathematics textbook, traditional games

INTRODUCTION

Computational thinking is one of the important skills that should be cuntivated in our students in today's globalized and dramatically changing world (Yadav et al., 2016). It was first introduced by Seymour Papert (Papert, 1980) and then reintroduced by Jeanette Wing (Wing, 2006) who mentioned it as one of the basic competences that complement literacy and numeracy skills (Lodi & Martini, 2021). It is defined as the ability to analyze a problem and present the solution (Wing, 2017). Computational thinking can also be understood as students' ability to solve a problem, understanding behavior by describing concepts and designing systems so that it can be solved properly (Weintrop et al., 2016). Therefore, teachers need to have a better understanding of how computational thinking can be integrated into their students' learning by promoting problem solving and critical thinking skills.

Computational thinking may be seen as a more general problem-solving strategy, which can be applied to different domains beyond computer science (Kale & Yuan, 2021). Therefore, computational thinking has been suggested to be a fundamental cognitive ability that should be acquired in education - comparable to literacy and numeracy (Tsarava et al., 2018). The rapid development of science and technology requires an effective strategy to develop computational thinking, one of which is through existing culture, so that students remain rooted in their own culture (Dousay, 2021, Putra et al., 2022, Vieira & Hai, 2022). A large global culture is currently needed; education that relates to culture that prepares students to have a local identity and recognize the identity of the nation with the aim of improving the world together and introducing existing cultures to others (Owens, 2014). In Indonesian contexts, as of 2017 there is a law (number 5) concerning the promotion of culture in order to protect, utilize, and develop Indonesian culture. Within education, we can integrate culture into learning using traditional games (Republic of Indonesia, 2017).

Indonesia is rich in traditional games that have been passed down from generation to generation (Jabar et al., 2022). Therefore, teachers can use traditional games in learning activities. Through games, students can express their thoughts and feelings, in turn making students' cognitive abilities increase because learning can be well received (Wulandari et al., 2022). Traditional games can support various aspects of a child's development, including motor, social, cognitive, emotional, language, spiritual, moral and environmental (Misbach, 2006). Traditional games can foster cognitive intelligence, emotional abilities, and creativity (Nurhayati, 2012); children become more dynamic and innovative. Traditional games can also be used as therapy for children. They foster children's pluralistic intelligence including nurturing children's insights, fostering children's relational abilities to understand individuals at a deeper level as well as fostering children's thinking, spatial and spiritual skills.

Although there have been many studies on traditional games, we find a lack of study connecting traditional games to computational thinking skills. This is significant because traditional games are one of the activities that have developed in society that are still played in order to preserve the richness of culture (Suteja et al., 2022), whereas computational thinking skills are thinking skills that lead students to more complex thinking in solving problems while playing the games (Lin et al., 2020). Furthermore, traditional games are still popular and played by many children, which motivates us to build computational thinking skills through traditional games. A study conducted by Putra et al. (2022) has developed computational thinking tasks based on Riau Malay culture, and we found that they have developed some tasks based on traditional games. Thus, there is a potential to develop computational thinking learning resources based on traditional games. The present study concerns developing a traditional game-based computational thinking supplementary textbook for elementary schools. The textbook is expected to be an additional learning reference for teachers in supporting students' computational thinking skills. Thus, this study specifically seeks answers to the following questions:

(1) How is a traditional game-based computational thinking supplementary textbook developed?

(2) How beneficial is the traditional game-based computational thinking supplementary textbook for classroom use in elementary schools as evaluated by experts?

(3) What are students' views on the traditional game-based computational thinking supplementary textbook?

Computational Thinking Skills

Computational thinking is a term that refers to the fundamental thoughts and ideas that exist in the field of software engineering and informatics (Bocconi et al., 2016). According to Wing (2006), computational thinking includes the capacity to handle problems, plan frameworks, and understand how humans behave by drawing on important ideas for software engineering. For reading, writing, and arithmetic, we must add computational thinking to the scientific capacity of every child (Wing, 2006). Computational thinking is a way of thinking that is needed in formulating problems and solutions, so that these solutions can become effective information processing agents in dealing with problems(Putra et al., 2022). Although computational thinking is a way of solving problems and finding solutions using computer concepts, it is also an important skill in the field of mathematics.

Computational thinking has four basic skills consisting of decomposition, pattern recognition, abstraction, and algorithm (Gunawan et al., 2023; Putra et al., 2022; Safitri et al., 2023). These four skills need to be cultivated in our elementary school students to promote their ability to deal with complex mathematical problems. First, decomposition is a skill used in breaking down problems into simpler forms so that they can be solved, developed, and evaluated to understand the complexity of a problem. A complexproblem will be easier to solve if someone breaks the problem into smaller parts. Second, pattern recognition relates to a skill in finding the correct pattern. This skill is needed for some problem-solving tasks. Recognizing recurring patterns or characteristics of the problem is a strategy that will make it easier to find solutions or find similarities between various problems. Third, abstraction is a skill to identify and recognize relationships, similarities, and differences that are most important to a problem, while ignoring information that is considered irrelevant to finding a solution. Finally, algorithm is the skill of getting to a solution through a clear set of steps.

Traditional Games

Games are a means of expressing one's emotions, involvement, experiences, hopes and self-satisfaction (Fitri et al., 2020). Games are also a tool for someone to keep their body and mind healthy and develop their character. Character development occurs because of changes in the nature of the game and changes in the social environment (Varzani, 2013). A game is an activity that is supportive of personality of elementary school students. The game is an act to entertain the heart using tools or without tools, and it is fun exercise for students.

Traditional games are hereditary practices that develop and cultivate in certain areas, which contain social characteristics; the advantages of local life are taught from one era to another. Traditional games have playing conditions that are associated with certain principles or goals (Misbach, 2006). Associating children with traditional games can nurture the qualities of creative thinking, responsibility, and cooperation.

Traditional games are exercises that have been carried on for a long time and have determined rules that must be followed and passed down from one generation to another using basic tools and according to their traditions (Achroni, 2012). There are several characteristics that must be considered to make a game 'traditional': (1) when playing games you must use simple tools which are easy to obtain and materials that can easily be made yourself; (2) traditional games are played by several people because they are concerned with shared joy; (3) traditional games can invite players to have social interactions (Wijayanti, 2018).

The various advantages of traditional games as expressed by Misbach (2006) are that games can strengthen various aspects of a child's development including motor, social, cognitive, emotional, linguistic, spiritual, moral, and environmental. Nurhayati (2012) argues that the advantages of traditional games are that they can foster intellectual intelligence, develop emotional abilities, foster creativity, help children become more dynamic and innovative, can be used as therapy for children and can foster children's multiple intelligences, including: creating children's insights, cultivate children's relational abilities to understand individuals at a deeper level, cultivate children's thinking, spatial awareness and spirituality.

Traditional Games-Based Computational Thinking

Game-based learning is a learning approach that is able to support students' computational thinking skills. A computer game-based learning is commonly developede to support students' computational thinking skills. For example, Hooshyar et al. (2021) developed an adaptive educational computer game, called AutoThinking, to support elementary school students' computational thinking skills and conceptual knowledge. The results of this study show that learning based on adaptive educational computer games significantly improves students' computational thinking skills in both conceptual and skill aspects. In addition, students using the adaptive educational computer game showed a significantly higher level of interest, satisfaction, flow state, and technology acceptance in learning computational thinking. The same results were also shown by Yang et al. (2023), namely that a role-play-based micro-game strategy had a significant influence on students' computational thinking skills, especially in the dimensions of computational concepts and computational practices.

A lack of digital equipment is a major obstacle to the implementation of computational thinking in education, particularly for rural schools. Therefore, some studies have tried to develop computational thinking learning instruction and media without the use of digital technology, but integrating traditional games (Putra et al., 2022; Zhang et al., 2023). Zhang et al. (2023) in his study developed Game-Based Learning (GBL) using a newly designed board game and GBL with parental involvement. The results of the study show that GBL approaches (i.e., with and without parents) significantly enhanced the students' CT skills compared to the traditional approach. Meanwhile, Putra et al. (2022) have developed computational thinking tasks based on Riau Malay culture. The tasks were developed in various contexts, including the context of traditional games such as *galah panjang*. The tasks have been used to measure elementary school students' computational thinking skills (Gunawan et al., 2023; Safitri et al., 2023). Therefore, traditional games-based computational thinking instructional learning has a potential to be developed to support students' computational thinking skills.

METHOD

The type of research used in this study is research and development (R&D) (Branch, 2009; Pratiwi et al., 2022). This research aims to develop a product that can support students in learning computational thinking. The product here is a traditional game-based computational thinking supplementary textbook. In addition, the ADDIE research model (analyze, design, development, implementation, and evaluation) (Branch, 2009) was used to develop the traditional game-based computational thinking supplementary textbook (Figure 1). The reason for choosing the ADDIE model is because the concept of product development is applied in performance-based learning (Branch, 2009).

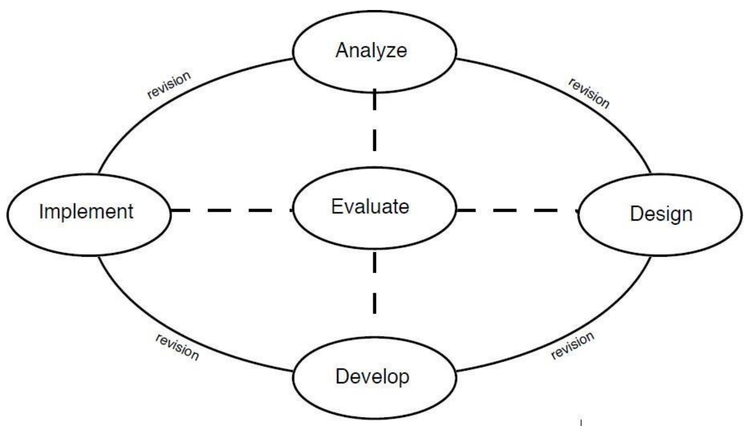

Figure 1. The ADDIE model (Branch, 2009)

The ADDIE model consists of five-phases (Branch, 2009; Mamolo, 2019). The first phase is analysis, which aims to determine whether the problem needs to be investigated and whether effort should be given toward resolution. The design phase follows to emphasize the description of the product that will be produced in the final stage of development. The purpose of the development phase is to have an expert review regarding the quality of the product. The implementation phase deals with real situations with actual learning, while the evaluation phase deals with reflecting on and revising upon the pilot stage to assess the quality of the product and process (Branch, 2009).

The first step taken by the researchers was to collect as much information as possible related to students' computational thinking abilities by conducting interviews with homeroom teachers regarding the learning process in the classroom, textbook references used, computational thinking of fourth grade students, and traditional games played by the students. At this stage, the researchers also carried out several processes including analysis of curriculum and learning resources, student characteristics and material analysis.

The second step was designing. This stage served a very important role because researchers began to organize the procedures to develop the product. These included: 1) searching for various supporting reference sources related to enrichment books and computational thinking skills for elementary school students; 2) making instrument grids as a follow-up step from observations and interviews that had been conducted previously; 3) planning the creation of the textbook by dividing the learning objectives according to each traditional game; 4) developing a supplementary textbook map; 5) creating a book structure consisting of an arrangement of parts which are then combined, so that it becomes a whole that is worthy of being called the supplementary textbook; 6) creating the supplementary textbook design using the *Canva* application and *Microsoft Word* application.

The third stage was development. Researchers conducted validation of the product by experts. Expert validation was carried out to determine the feasibility of a traditional game-based computational thinking supplementary textbook to be used as a learning reference. With the help of experts, book improvements were made appropriately. Expert validators for this study consisted of three experts; one mathematics expert, one cultural expert and one experienced elementary school Grade Four teacher.

After the process of validation of the product (the textbook) was completed and was declared to be feasible to be tested, the next stage was the implementation stage (sometimes called the trial stage). This is the stage of testing the book in real situations (Cahyadi, 2019). The researchers conducted the test of the supplementary textbooks twice. First, it was tested with 6 fourth grade students, focusing on two traditional games, *Congklak* and *Setatak*. The second test was with 12 fourth grade students, focusing on two other traditional games, *Galah Panjang* and *Yeye*. In the first test, the researcher (first author), explained the procedures of the game and the aspects of computational thinking in the game. While in the second test, the researcher divided the students into four groups to have them work collaboratively to play the games and to solve the computational thinking tasks in the supplementary textbook. After that, students were asked to fill out a questionnaire to share their thinking. All students were able to read the questions, but the researcher aided students who had difficulty with comprehension. After that, the researchers conducted an evaluation with the teacher and students regarding their learning experiences when using the supplementary textbooks.

The evaluation stage was carried out in each stage. Mean score from the experts was analyzed and interpreted as presented in table 1.

Table 1. Interpretation of validator to the computational thinking book.

Score	Category
$V > 0.8$	Very Valid/Very feasible
$0.4 \leq V \leq 0.8$	Valid/ feasible
< 0.4	Moderately Valid/ Not feasible

RESULTS

The traditional game-based computational thinking supplementary textbook was developed using the ADDIE model which consists of five stages. Therefore, the researchers present the results from each step as shown in the following subsections.

The analysis stage is divided into three stages, namely analysis of curriculum and learning resources, analysis of student character, and analysis of learning materials. The following is an explanation of the stages of analysis.

Analysis of Curriculum and Learning Resources

The curriculum is a set of experiences in the learning process that will be obtained by students while following an educational process (Fujiawati, 2016). The existence of a curriculum will make it easier for educators to achieve learning objectives. The curriculum will also make it uncomplicated for teachers to create concepts, methods and learning strategies for students.

Based on the information obtained when researchers were conducting interviews and observations, fourth grade students at the elementary school were still using the 2013 curriculum. Previously this school had implemented a new curriculum, called the independent curriculum, but the school returned to the 2013 curriculum because data from the national education center suggested that the school should continue using the 2013 curriculum. From the curriculum, the researchers formulated the objectives of mathematics learning and developed the learning resources for creating the supplementary textbook. The results of the analysis of the curriculum are presented in table 2.

Table 2. Indicators and Objectives.

No	Name of Game	Learning Materials	Indicators	Objectives
1.	*Congklak*	1. Operation of whole numbers	1. Students can perform addition, subtraction, multiplication, and	1. Students can perform arithmetic operations of addition, subtraction,

		2. Great common divisor (GCD) and least common multiple (LCM)	division of whole numbers. 2. Students can describe the difference between GCD and LCM. 3. Students can solve problems related to GCD and LCM	multiplication and division. 2. Students can find the difference between GCD and LCM. 3. Students can solve problems related to GCD and LCM with existing computational thinking skills.
2.	*Setatak*	1. Flat Shapes including square, rectangle, trapezoid, and circle. 2. Figures and number patterns.	1. Students can identify various kinds of flat shapes. 2. Students can explain the concept of perimeter and area of flat shapes. 3. Students can determine the pattern of figures and numbers.	1. Students can identify various kinds of flat shapes (square, rectangle, trapezoid, and circle) correctly. 2. Students can explain the concept of perimeter and area. 3. Students can determine patterns of figures and numbers using computational thinking skills.
3.	*Galah Panjang*	1. Relations between lines. 2. Perpendicular lines. 3. Parallel lines. 4. Intersecting lines.	1. Students can show the relationship between lines. 2. Students can draw lines based on their relationship. 3. Students can determine the relationship between lines.	1. Students can show the relationship between lines (perpendicular, parallel, and intersecting) correctly. 2. Students can draw lines based on their relationships during the learning process. 3. Students can determine the arrangement of perpendicular, parallel and intersecting lines with computational thinking skills.
4.	*Yeye*	1. Multiplication as Repeated Addition	1. Students understand the concept of multiplication as repeated addition. 2. Students can solve multiplication tasks	1. Students can explain the concept of multiplication as repeated addition. 2. Students can complete multiplication tasks with computational thinking skills.

	with repeated addition.

Analysis of Student Characters

The research aimed to develop a computational thinking enrichment book for elementary school students. The research was conducted at a public elementary school in Pekanbaru, Indonesia. The fourth-grade students ranged from 9–10-year-olds which means that students were still in the concrete operational stage (Piaget, 1976). Piaget suggested that children during this period are less egocentric; they display the ability to understand concepts and they can solve complex problems (Bjorklund, 2022). In addition, classification is another important characteristic of the concrete operational stage and children at this stage can classify objects into different types using different attributes such as shape, value, and size; children can also consider their associations. Therefore, in organizing learning activities, teachers should consider the level of students' thinking characteristics. Students should learn within a memorable personal experience process through activities provided by the teacher (Webb, 1980).

To be able to facilitate students to develop their computational thinking abilities through memorable experiences, teachers can use traditional games. Traditional games are games that have existed for generations which are part of the regional cultural heritage that must be sustained. In the interview, the teacher stated that students still play traditional games during recess such as playing a game called *Yeye*. With traditional games, students can learn by engaging in direct experience while feeling happy in the learning process. This is in line with traditional games for elementary school students, especially grade four elementary school students who have an age range of 9-10 years. These students are at the concrete operational level of thinking and they need visualizations in order to achieve the expected competencies.

Analysis of Learning Materials

The analysis of learning materials was carried out in order to ensure that the supplementary textbook was aligned with the desired learning objectives. The material was selected in accordance with the analysis previously carried out by researchers, namely by dividing the four traditional games, *Congklak, Setatak, Galah Panjang and Yeye* in accordance with the computational thinking skills, namely decomposition, pattern recognition, abstraction and algorithm thinking. This will be used as a reference by researchers in developing traditional game-based computational thinking supplementary textbooks for elementary school students. The mathematical concepts which will be introduced to the children through traditional games include number operations, great common divisor and least common multiple, flat shapes, and relationships between lines.

Design

Before starting the design stage, researchers collected materials related to mathematics learning that could be developed through the traditional games of *Congklak, Setatak, Galah Panjang* and *Yeye*. The researchers looked for various references related to possible activities connected to computational thinking that were appropriate for elementary school students. The product design was carried out by researchers starting with compiling a map of supplementary textbooks according to the needs of teachers and students. The design of the product began by drafting an initial version of the supplementary textbook manually (written) and then finalizing it using *Canva* and *Microsoft Word* applications. The supplementary textbook comprises 3 parts, namely the beginning, the core section and the final section. The initial part of the traditional game-based computational thinking supplementary textbook contains a cover, preface, table of contents, and introduction to computational thinking. In the core section, the researchers presented the computational thinking skills aligned with the four traditional games; *Congklak*, *Setatak*, *Galah Panjang*, and *Yeye*. The final part of the supplementary textbook contains exercises, references, and authors' information. The evaluation at the design stage carried out by the researchers through self-evaluation and a focus group discussion focused on several activities that needed improvement in order to address computational thinking skills.

Development

At this stage, the researchers started to finalize the supplementary textbook into a real product, which was validated by experts. The following sections present the content of the supplementary textbook and the results of the validation.

Contents of the Supplementary Textbook

The supplementary textbook begins by giving a brief introduction to computational thinking skills. It also contains some explanations of the four computational thinking skills with a link to traditional games (Figure 2).

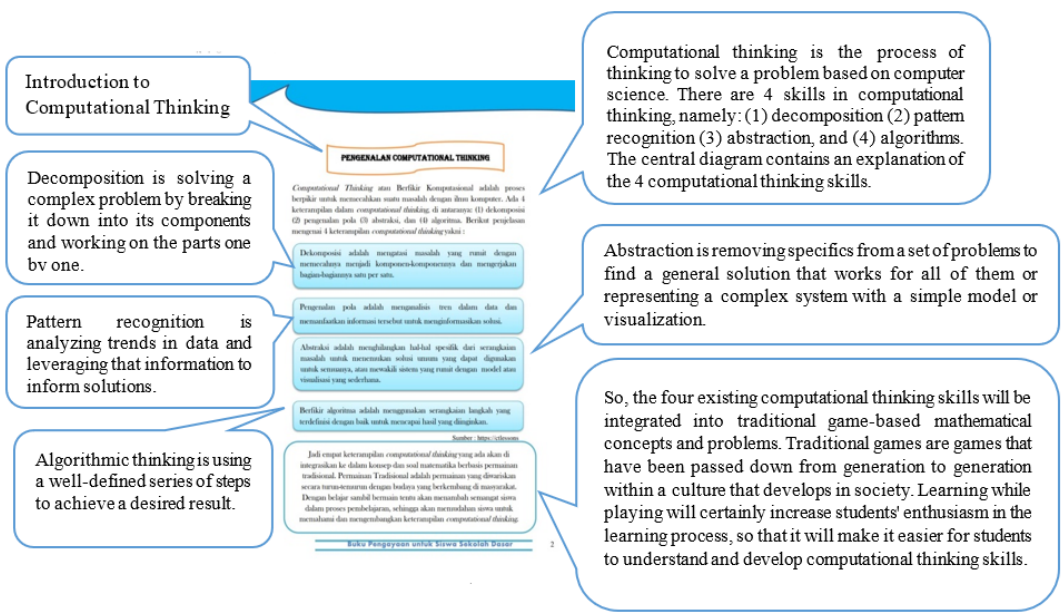

Figure 2. Introduction to Computational Thinking

The core part of the supplementary textbook presents four sections, and each section focuses on one specific computational thinking skill and traditional game. The section is supported by pictures and texts. For example, the first section discusses the traditional game of *Congklak*, so the illustrations and text content presented are also related to this game (Figure 3). The text content presents the history, procedures, and benefits of the game. The subsection contains some material that can be integrated into (introduced through) the traditional game. This includes problems and solutions using computational thinking skills. At the end of each section, there are computational thinking challenges in the form of traditional game-based computational thinking problems that students can solve to promote their problem solving abilities.

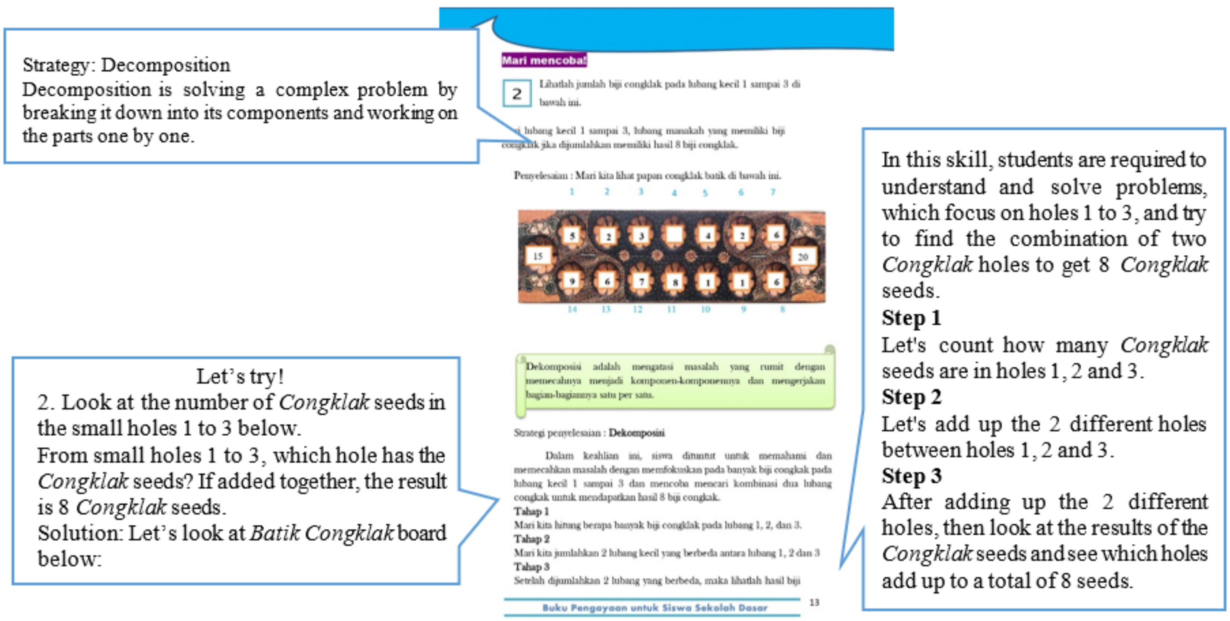

Figure 3. The Core Section of the Supplementary Textbook

At the end, there is an explanation of each computational thinking skill developed in each activity. The exercise at the end of the supplementary textbook presents some challenging tasks that can combine two or more computational thinking skills. Figure 3 presents an example of the task.

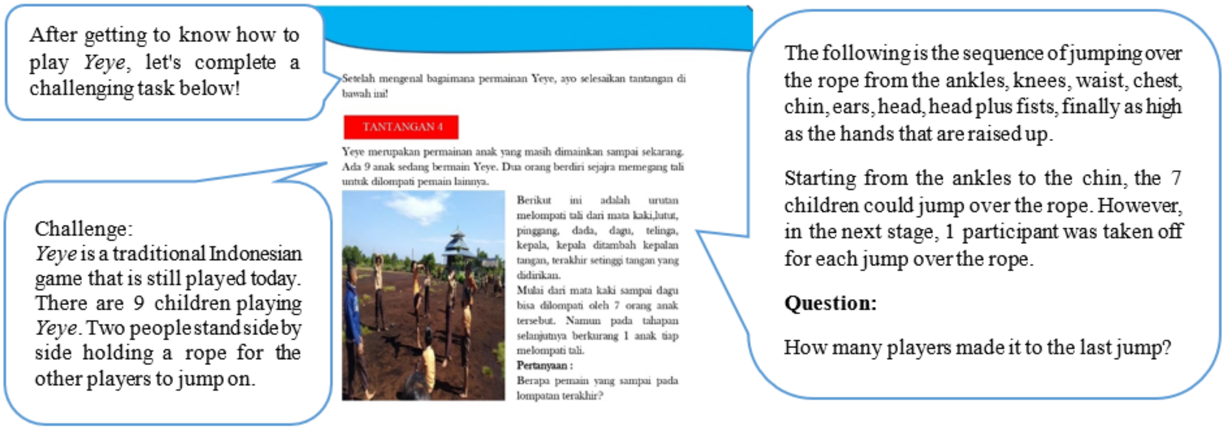

Figure 4. An Example of Tasks in the Exercise Section

Product Validation

Expert validation aims to determine the feasibility of the supplementary textbook developed before testing it on students. Expert validation was conducted by three experts. They evaluated the design and content of the book (Table 3). Overall, the design and content of the traditional game-based computational thinking supplementary textbook achieved the category of highly valid. This means that the supplementary textbook is suitable to be tested on elementary school students.

Table 3. The Results of Validation.

Variables	Score	Criteria
Product Design	0.92	Very Valid
Content of the Book	0.91	Very Valid
Average	0.91	Very Valid

Implementation

The traditional game-based computational thinking supplementary textbook was validated by experts and then tested with 20 fourth grade elementary school students. The first researcher conducted the test with the students. Before conducting the test, the researcher asked permission from the teacher, collected information regarding student background, divided students intogroups and prepared instruments for the data collection. The researcher selected 3 students for the *Congklak* game and 3 students for the *Setatak* game. Then, the researcher selected 8 students for the *Galah Panjang* game and 4 students for the *Yeye* game. At the beginning of the meeting, the researcher provided an explanation of the activities, including a brief explanation about computational thinking skills and how they could be learned through traditional games.

Learning computational thinking skills began with the delivery of material related to computational thinking in line with the supplementary textbook that was developed. The first researcher, acting as the teacher, explained and discussed several traditional games and prompted students to see the connection between these games and computational thinking skills. Next, students played these traditional games in groups in the school field (Figures 5, 6, and 7), except for the *Congklak* game, which was played in the classroom. The first researcher noticed a high level of engagement and enthusiasm between students while they were playing the games.

The *Congklak* game aims to build students' computational thinking skills about abstraction and decomposition. When a student moves *Congklak* seeds (Figure 5), she has to focus on filling her holes and ignore her opponent's holes. In filling her holes, she has to predict which seeds she should carry so that her holes are filled more and so that she does not stop at an empty hole. This is related to abstraction because it requires a focus only on important factors while ignoring other factors.

Figure 5. Students while playing *Congklak*

The first researcher, then linked the game to the computational thinking skills of decomposition by asking students to look at holes 1 to 3 on the *Congklak* and determine the two *Congklak* holes that add up to a certain number. Students started counting and adding. In this case, students were prompted to understand and solve problems by looking for holes that add up to certain results. The researcher explained to students that the activities they carried out were related to decomposition, namely the process of solving complex problems by breaking them down into small components.

The second game was *Setatak* (Figure 6), which included two computational thinking skills; pattern recognition and algorithm thinking. While the students were forming a pattern of shapes, the researcher asked them questions about the pattern that they were forming (one by one) and related them to various flat shapes. The researcher asked the students about the number of different flat shapes they drew, and the students answered that there were three types of shapes. When the researcher asked the students to explain how they knew that there were three types of flat shapes, the students explained that they saw from their drawings. Based on students' actions and responses, the researcher concluded that students recognized the different types of flat shapes based on some properties of the shapes. This is one aspect of computational thinking, namely pattern recognition.

Figure 6. Students playing *Setatak*

After the students had finished forming the *Setatak* pattern, the researcher explained how to play the *Setatak* game for some of them who could not yet form/notice the pattern. Teaching students how to play the game step by step is related to another aspect of computational thinking, namely algorithmic thinking; the ability to use a series of well-defined steps to achieve the desired result. After all participating students understood the game, the researcher conducted a discussion by asking them to count the number of shapes that they had to jump when the *gaco* (a stone used by each player to be put on different *Setatak* shapes) was placed in different positions. In this case, students were invited to explore how many shapes they had to go through from the start to the end of the game.

In the *Yeye* game (Figure 7), the researcher began by demonstrating two computational thinking skills; algorithmic thinking and pattern recognition. After the students took turns playing, the researcher asked the students a question about the activities they had done from start to finish. The students explained the steps they followed in playing the game. The researcher explained that the initial activities they carried out until they reached the highest peak and accordingly won the game, represent an aspect of computational thinking, namely algorithmic thinking. The researcher then asked how many rope jumps had to be passed to get to the highest level. Students started counting and sharing their responses enthusiastically. The researcher then gave a different problem by asking: 4 players were jumping such that, the first player could jump up to their knees, the second player could jump up to their waist, and the fourth player could jump up to the span of one hand. If the third player could jump up to any part, what would it be? Students began to think and search, but experienced confusion. The researcher then intervened by relating each jump to a number. This part of the activity was related to the pattern recognition aspect of computational thinking, where the jumps are up to ankles, up to knees, up to waist, up to chest, up to chin, up to head, up to one-handed span, and up to two-handed span. By giving each jump a code: ankle (1), knee (2), waist (3), chest (4), chin (5), head (6), one-handed span (7), and two-hand span (8), the pattern of the 4 players in the problem is 2,3,...,7. The students had to guess a possible number between 3 and 7.

Figure 7. Students playing *Yeye.*

In the *Galah Panjang* game, the researcher began to demonstrate two computational thinking skills; abstraction and pattern recognition. The activity began with the researcher explaining the game and asking students to work together to draw a playing field using the remaining bricks. Before drawing the field pattern, the researcher asked what tools were needed for the game. Students replied that they would be using the remaining bricks to draw the playing field pattern. The researcher then asked students to look for bricks in the schoolyards. After bricks were collected by the students, the researcher focused students' attention on the "remaining bricks" that would be used to create the playing field. This demonstrated the computational thinking skill of abstraction, which is finding the thing to focus on by ignoring other things. The researcher continued by asking the students to draw a pattern (playing field) using the remaining bricks they collected. While the students formed a *Galah Panjang* pattern, the researcher asked about the shapes that the students were creating and related them to the relationships between the lines that they formed. The researcher also asked how many rectangle shapes should be formed when each team consists of four people and how many straight and intersecting lines are formed. After students finished drawing the playing field, the researcher explained the game (the long pole game) again for those who were not able to participate effectively the first time.

The researcher asked each group to start thinking of playing strategies to win the game because students only knew they could run without looking at their opponents. In this case, the researcher taught students aspects of computational thinking, where building strategic plans, seeking support from teammates, and creating a winning strategy are all activities related to decomposition skills.

After playing, students were asked to complete computational thinking tasks that were in line with the game they had played. Students were able to understand the instructions presented in the supplementary mathematics textbook and were able to solve the tasks presented. The students were also interviewed regarding their experiences learning computational thinking using traditional games. Following is an interview excerpt with student A:

Resercher: How do you feel after learning while playing?

Student A: Very happy!

Resercher: Does learning through playing make you more interested in learning mathematics?

Student A: Yes, I am interested because learning mathematics is very fun.

Resercher: Do traditional games make you understand the mathematics content better?

Student A: The first time I was confused and after playing traditional games I was able to understand it.

Resercher: Can you understand after playing traditional games?

Student A: Yes, because traditional games need to be understood carefully in order to play.

Resercher: What is the most memorable thing you got from learning this subject by using traditional games?

Student A: Through playing *Galah Panjang*, I was happy when playing with friends but none of us won.

Student A was very happy playing the traditional game. She could understand how the game was played, and she was able to understand mathematical knowledge to be learned in the supplementary mathematics textbook. However, we noticed that students did not talk very much regarding the mathematical content that they had learned through traditional games.

Evaluation

Evaluation in this research was carried out formatively. This means that every step of research and development is evaluated. The evaluation carried out was related to evaluation from experts and evaluation of the results of trials with the students.

DISCUSSION

Computational thinking is a skill that is needed in line with current developments in science and technology. On the other hand, local culture must still be maintained so that it does not vanish over time. Therefore, education today requires ideas that integrate knowledge with culture. This research addressed this need by developing a traditional game-based computational thinking supplementary textbook for elementary school students. From the experts point of view, the supplementary mathematics textbook developed has fully met criteria. Therefore, this media can continue to the practicality testing stage with elementary school students.

The supplementary mathematics textbook developed contains four traditional games that are usually played by Indonesian children with four computational thinking skills. The integration of traditional games with computational thinking skills is carried out simultaneously so that students can enjoy the game without realizing that they are also developing their computational thinking skills. The games require prompt problem solving, collaboration, and creative thinking abilities from students (Espigares-Gámez, 2020, van den Heuvel-Panhuizen et al., 2013).

The development of the supplementary mathematics textbook used a research and development approach with the ADDIE model. The first stage was analysis where the researcher analyzed the curriculum, student character, and also learning materials (content). The mathematics curriculum in elementary schools in Indonesia does not yet explicitly contain computational thinking. This is very different when compared with other countries' curricula. For example, in the UK computational thinking has been included in the curriculum since 2013 (Larke, 2019, Manches & Plowman, 2017, Willianson, 2016). However, some of the mathematics content in the 2013 curriculum in Indonesia can be linked to computational thinking and also to traditional children's games in Indonesia. This is in line with the analysis of student development where children at elementary school age still think concretely and semi-concretely (Piaget, 1976). They display the ability to understand conceptual things and they can solve complex problems (Bjorklund, 2022). Additionally, classification is another important characteristic of the concrete operational stage and children at this stage can classify objects into different types using different attributes such as shape, value, and size. Children can also consider their associations. Therefore, in organizing learning activities, teachers should consider the level of students' thinking and its different characteristics (Fatmanissa et al., 2023).

To facilitate students developing computational thinking skills through memorable experiences, teachers can use traditional games. Traditional games are games that have been played for generations and are one of the cultural elements that must be developed and sustained. Through traditional games, students can learn by engaging in direct experience and feeling happy during the learning process. Traditional games for elementary school students, especially those aged 9-11 years, should be adapted to the level of concrete operational thinking. Therefore, students need visualization to achieve the expected competencies.

The design and development stages are two stages that focused on creating and developing the traditional game-based computational thinking supplementary textbook for elementary school students. During these stages, researchers played an important role in integrating computational thinking, traditional games, and mathematical content into the curriculum. The product that has been designed was then evaluated for suitability by experts. This is in line with existing procedures in research and development (Mamolo, 2019). The expert assessment regarding the supplementary mathematics textbook obtained a very strong score so that the product developed has considered to be very effective. Based on the experts' evaluation of the product (the textbook), it was considered ready to be tested with students to examine its practicality.

The supplementary mathematics textbook was tested with elementary school students. The test results show that students enjoy playing traditional games and could understand the mathematical content during the game. This is in line with Sitanggang et al. (2020) who argue that learning while playing will give rise to feelings of joy, and from these feelings, students are interested in understanding the learning being delivered. In our study, students were engaged with a game that required them to develop a strategy to win the game so that some computational thinking skills were developed in solving the problems they faced (Kazimoglu, 2012).

The integration of computational thinking in traditional games is in line with Law Number 5 of 2017 concerning the promotion of culture which aims to protect, utilize and develop Indonesian culture (Republic of Indonesia, 2017). This integration can increase students' knowledge regarding Indonesian culture by utilizing traditional games in learning. In addition, the integration of traditional games promoted students' understand of the mathematical material. Kurniati (2017) argued that, through games, students can express thoughts and feelings which improve students' cognitive aspects because learning can be well received. We concluded that computational thinking can be introduced not only through technology but also through traditional games.

CONCLUSIONS

The traditional game-based computational thinking supplementary textbooks are feasible to be used as a reference for mathematics learning to develop students' computational thinking skills. Based on our findings, we encourage elementary school teachers to use this supplementary textbook and traditional games to develop students' computational thinking. The validation test results showed that the traditional game-based computational thinking supplementary textbook for elementary school students was very valid. The students gave a positive response by mentioning that they liked the learning process with traditional games. Thus, the traditional game-based computational thinking supplementary textbook is considered to be feasible to use and effective for teachers and students.

This supplementary textbook can help teachers incorporate traditional games into mathematics learning by utilizing it to foster a fun and engaging learning environment in the classroom. Therefore, the researchers believe that teachers' utilization of the textbook can promote their students' computational thinking skills using traditional games. As for students, this book can help them in developing some computational thinking with(in) a relevant context in the form of traditional games. For further investigation, researchers can refine this traditional game-based computational thinking textbook and can test it at other grade levels. In addition, it can also aid development of other books with variations of computational thinking questions and other traditional games to add more book references for teachers and students.

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